

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2018/2019

PMT0204 – FUNDAMENTAL MATHEMATICS II

(All sections / Groups)

24 OCTOBER 2018

2.30 p.m. – 4.30 p.m.

(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of **FIVE (5)** printed pages with 4 questions only including the cover page and appendix.
2. Answer all **FOUR (4)** questions
3. Write all your answers in the answer booklet provided.
4. Only **NON-PROGRAMMABLE** calculator is allowed.

Question 1 (25 Marks)

- a) Given that $M = \begin{pmatrix} 4 & 3 \\ -2 & 6 \end{pmatrix}$, $N = \begin{pmatrix} 2 & -5 \\ 8 & -3 \end{pmatrix}$, $L = \begin{pmatrix} a \\ b \end{pmatrix}$ and $K = \begin{pmatrix} 6 & 8 \end{pmatrix}$, so that

$$K \times (M - N) = L.$$

- Determine the value of a and b . (4 marks)
- Compute the inverse matrix of M . (3 marks)
- Solve for $X = \begin{pmatrix} x \\ y \end{pmatrix}$ by using your solution in part (i) and (ii) $X = M^{-1}L$. (3 marks)

- b) Maria makes pudding which consist of three flavors; Vanilla, Chocolate, and Strawberry. The following table summarize the amount of ingredient she adds to each flavor and the total number of stock available:

Ingredient	Flavor			Total Stock of Ingredients
	Vanilla	Chocolate	Strawberry	
Fruit	2	1	1	257
Chewy Pearl	1	1	2	259
Grass Jelly	2	2	1	332

[Hint: Let x , y , and z be the vanilla, chocolate and strawberry flavor respectively.]

Solve the value of x , y and z by using the *Cramer's Rule*. (15 marks)

Question 2 (25 Marks)

- Express 26° in radian. (2 marks)
- A supermarket needs to build a trolley ramp. If the vertical distance (height) from the sidewalk to the front door is 60 cm and the length of the ramp is 150 cm, find the suitable angle of elevation for the ramp. (3 marks)
- Given the function $3y = 6 \cos\left(2x - \frac{2\pi}{3}\right)$,
 - find the amplitude, period and phase shift. (4 marks)
 - sketch and label the graph of the given function. (5 marks)
- Write the complex number, $z = 3 + 4i$ in polar form of $z = r(\cos \theta + i \sin \theta)$. (5 marks)
- Find the internal angles of the triangle if given three sides; $a = 10$, $b = 5$, $c = 7$. (6 marks)

Continued...

Question 3 (25 Marks)

a) Find the limit if exist.

i. $\lim_{x \rightarrow 1} 5x^2 - 7$ (2 marks)

ii. $\lim_{x \rightarrow 2} \frac{3x + 9}{x^2 - 9}$ (4 marks)

iii. $\lim_{x \rightarrow \infty} \frac{3 - 4x^3}{2x^2 - 3}$ (4 marks)

b) Differentiate $y = \frac{4}{x^2} + 3e^x + \cos x - \pi$. (2 marks)

c) Use product rule to find the derivative of $y = (1 - x)(\ln x)$. (5 marks)

d) Given the function $f(x) = x^3 - 3x + 3$,

i. find the critical number(s). (3 marks)

ii. identify the intervals on which f is increasing or decreasing. (3 marks)

iii. determine the maximum and/or the minimum value(s). (2 marks)

Question 4 (25 Marks)

a) Integrate

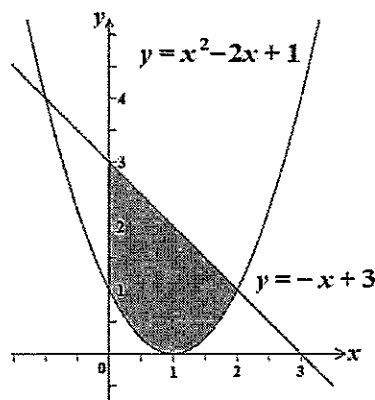
i. $\int \left(2x^3 + 7e^x - \frac{3}{x} \right) dx$. (4 marks)

ii. $\int_1^6 (9x^2 - 8x + 10) dx$. (6 marks)

b) Use integration by substitution to determine $\int 2x(7x^2 + 5)^8 dx$. (5 marks)

c) Using integration by part, integrate $\int x \cos x dx$. (4 marks)

d) Find the area of the shaded region below, bounded by $y = x^2 - 2x + 1$, $y = -x + 3$ and the sides from $x = 0$ until $x = 2$. (6 marks)

**End of Page.**

APPENDIX

Matrices

Inverse of a 2×2 matrix

If $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, then $A^{-1} = \frac{1}{ad-bc} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$, where $ad-bc \neq 0$.

Determinant of a 3×3 matrix

$$\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} = a_1 \begin{vmatrix} b_2 & c_2 \\ b_3 & c_3 \end{vmatrix} - b_1 \begin{vmatrix} a_2 & c_2 \\ a_3 & c_3 \end{vmatrix} + c_1 \begin{vmatrix} a_2 & b_2 \\ a_3 & b_3 \end{vmatrix}$$

Cramer's Rule for 3×3 matrix

$$a_1x + b_1y + c_1z = d_1$$

$$a_2x + b_2y + c_2z = d_2$$

$$a_3x + b_3y + c_3z = d_3$$

then $x = \frac{D_x}{D}$, $y = \frac{D_y}{D}$, $z = \frac{D_z}{D}$ where

$$D = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}, D_x = \begin{vmatrix} d_1 & b_1 & c_1 \\ d_2 & b_2 & c_2 \\ d_3 & b_3 & c_3 \end{vmatrix}, D_y = \begin{vmatrix} a_1 & d_1 & c_1 \\ a_2 & d_2 & c_2 \\ a_3 & d_3 & c_3 \end{vmatrix}, D_z = \begin{vmatrix} a_1 & b_1 & d_1 \\ a_2 & b_2 & d_2 \\ a_3 & b_3 & d_3 \end{vmatrix}$$

Trigonometry

Law of Sine

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

Law of Cosine

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$b^2 = a^2 + c^2 - 2ac \cos B$$

$$c^2 = a^2 + b^2 - 2ab \cos C$$

Pythagorean Identity

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$\tan^2 \theta + 1 = \sec^2 \theta$$

$$1 + \cot^2 \theta = \csc^2 \theta$$

Derivatives

$$f'(a) = \lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h}$$

Differentiation Rules**General Formulae**

$$\begin{aligned}
 1. \quad \frac{d}{dx}[f(x)g(x)] &= f(x)g'(x) + g(x)f'(x) & 2. \quad \frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] &= \frac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2} \\
 3. \quad \frac{d}{dx}(x^n) &= nx^{n-1} & 4. \quad \frac{d}{dx}[f(u)] &= \frac{dy}{du} \cdot \frac{du}{dx}
 \end{aligned}$$

Exponential and Logarithmic Functions

$$\begin{aligned}
 1. \quad \frac{d}{dx}(e^x) &= e^x & 2. \quad \frac{d}{dx}(a^x) &= a^x \ln a \\
 3. \quad \frac{d}{dx}(\ln x) &= \frac{1}{x} & 4. \quad \frac{d}{dx}(\log_a x) &= \frac{1}{x \ln a}
 \end{aligned}$$

Trigonometric Functions

$$\begin{aligned}
 1. \quad \frac{d}{dx}(\sin x) &= \cos x & 2. \quad \frac{d}{dx}(\cos x) &= -\sin x \\
 3. \quad \frac{d}{dx}(\tan x) &= \sec^2 x & 4. \quad \frac{d}{dx}(\csc x) &= -\csc x \cot x \\
 5. \quad \frac{d}{dx}(\sec x) &= \sec x \tan x & 6. \quad \frac{d}{dx}(\cot x) &= -\csc^2 x
 \end{aligned}$$

Table of Integrals

$$\begin{aligned}
 1. \quad \int u \, dv &= uv - \int v \, du & 2. \quad \int u^n \, du &= \frac{u^{n+1}}{n+1} + C, \quad n \neq -1 \\
 3. \quad \int \frac{du}{u} &= \ln|u| + C & 4. \quad \int e^u \, du &= e^u + C \\
 5. \quad \int \sin u \, du &= -\cos u + C & 6. \quad \int \cos u \, du &= \sin u + C \\
 7. \quad \int \sec^2 u \, du &= \tan u + C & 8. \quad \int \csc^2 u \, du &= -\cot u + C \\
 9. \quad \int \sec u \tan u \, du &= \sec u + C & 10. \quad \int \csc u \cot u \, du &= -\csc u + C
 \end{aligned}$$

Application of Integrals:**Areas Between Curves**

$$A = \int_a^b [f(x) - g(x)] dx$$

$$A = \int_c^d [w(y) - v(y)] dy$$

Volume by Disks

$$V = \int_a^b \pi [R(x)]^2 dx$$

$$V = \int_c^d \pi [R(y)]^2 dy$$

Volume by Washer

$$V = \int_a^b \pi ([f(x)]^2 - [g(x)]^2) dx$$

$$V = \int_c^d \pi ([w(y)]^2 - [v(y)]^2) dy$$